HOG CHOLERA:

PREVENTION AND TREATMENT

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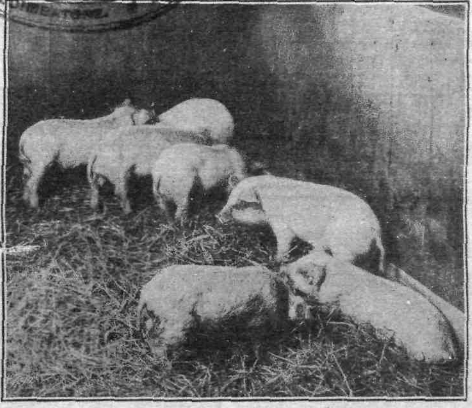
No. 262
18 DEC 1917
Coimbatore



The two pigs shown in foreground are affected with hog cholera

FARMERS' BULLETIN 834

UNITED STATES DEPARTMENT OF AGRICULTURE

Contribution from the Bureau of Animal Industry
A. D. MELVIN, Chief

Washington, D. C. August, 1917

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WASHINGTON : GOVERNMENT PRINTING OFFICE : 1917

HOG CHOLERA destroys about 90 per cent of all hogs that die from disease in the United States. The losses have amounted to between 6,000,000 and 7,000,000 hogs in one year, and the money loss probably has averaged more than $30,000,000 a year for the last 40 years.

The Federal Government and the State authorities aim at the ultimate eradication of the disease. At present the object is to bring it under strict control so as to reduce losses to the minimum.

Cooperation by farmers with each other and with the Federal Government and State authorities is essential to success.

The infection is carried easily from one place to another in a great variety of ways. Hence the need of care and cooperation by all concerned.

Sanitation, disinfection, and a self-imposed quarantine are important when the disease is in the neighborhood.

Prevention is better than cure. In fact there is no specific cure. So-called hog-cholera medicines are a snare and a delusion. The Bureau of Animal Industry for many years has made a study of the disease and finally evolved the "anti-hog-cholera serum," which can be regarded as the only known reliable preventive agent. It is the only agent which has been proved to have curative properties. This serum is now manufactured by several State institutions and by private firms licensed by the Secretary of Agriculture for the purpose. The use of the serum is described fully herein, including treatment of herds, brood sows, young pigs, etc.

Confine sick hogs.

Use serum.

Employ sanitary measures.

Disinfect.

Cooperate.

HOG CHOLERA: PREVENTION AND TREATMENT.

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PREVALENCE.

HOG CHOLERA, the most serious disease of hogs, is found in practically all parts of the world. In this country it appeared first in 1833, in Ohio, and later spread to every State in the Union. It is most prevalent in the States of the Middle West and of the South, where hogs are raised in greatest numbers. The Pacific Coast States remained practically free from hog cholera until recent years, probably because of the limited production of hogs and their limited importation from the infected districts of the country.

In the South, where the winters are mild and the temperatures more or less uniform, severe outbreaks of hog cholera may occur at any season of the year, but from statistics collected from experiments conducted in 14 States, principally in the Middle West, it has been shown that the disease reaches its greatest height during October and November. After this time it dies down rapidly, particularly after snow falls, and reaches its lowest point during February.

LOSSES FROM HOG CHOLERA.

While hog cholera has been present in this country continually for more than 50 years, it has been unusually prevalent in certain periods. The first period of exceptional prevalence reached its climax in 1887, the second in 1897, and the third apparently reached its height in 1913 and 1914. During these periods the hog-raising industry over the entire country suffered great losses and in some localities was for a time practically destroyed.

TABLE 1.—*Estimated number of hogs in each State on Jan. 1, and losses from hog cholera for year ending Mar. 31, 1913 to 1917.*

State.	1917		1916		1915		1914		1913	
	Hogs on hand.	Losses from cholera.	Hogs on hand.	Losses from cholera.	Hogs on hand.	Losses from cholera.	Hogs on hand.	Losses from cholera.	Hogs on hand.	Losses from cholera.
Iowa	9,370,000	337,320	9,069,000	448,916	8,720,000	1,216,440	6,976,000	1,601,010	8,720,000	1,255,6[illegible]
Illinois	4,444,000	163,984	4,489,000	404,010	4,358,000	470,664	4,358,000	549,090	4,315,000	543,690
Nebraska	4,309,000	174,514	4,266,000	191,970	3,809,000	385,661	3,228,000	508,410	3,798,000	376,020
Missouri	4,280,000	200,304	4,505,000	385,178	4,250,000	353,813	4,250,000	344,250	4,087,000	643,680
Indiana	3,970,000	214,380	4,010,000	408,783	4,167,000	457,537	3,969,000	482,220	3,709,000	500,760
Ohio	3,527,000	120,623	3,713,000	250,628	3,640,000	262,080	3,467,000	265,230	3,399,000	263,070
Texas	3,229,000	136,587	3,197,000	172,633	2,880,000	174,960	2,618,000	176,760	2,493,000	100,980
Georgia	2,585,000	186,120	2,348,000	190,188	2,042,000	165,402	1,945,000	157,500	1,888,000	280,350
Kansas	2,535,000	63,882	2,815,000	159,611	2,656,000	144,619	2,350,000	122,670	2,611,000	281,970
Wisconsin	2,060,000	48,204	2,142,000	48,195	2,255,000	76,106	2,050,000	92,250	2,030,000	51,120
Alabama	1,850,000	116,550	1,715,000	100,328	1,559,000	115,796	1,485,000	133,650	1,456,000	144,180
Minnesota	1,733,000	34,313	1,716,000	46,332	1,716,000	188,417	1,430,000	275,400	1,702,000	84,240
Mississippi	1,698,000	99,333	1,617,000	87,318	1,540,000	180,180	1,467,000	137,340	1,482,000	205,380
Louisiana	1,584,000	149,688	1,553,000	118,805	1,412,000	133,434	1,398,000	157,320	1,412,000	139,770
Kentucky	1,589,000	85,806	1,709,000	107,667	1,582,000	113,904	1,507,000	122,040	1,638,000	140,040
Arkansas	1,575,000	184,275	1,589,000	154,451	1,573,000	173,929	1,498,000	168,480	1,529,000	220,140
North Carolina	1,550,000	69,750	1,550,000	72,045	1,525,000	68,625	1,362,000	61,290	1,335,000	69,660
Tennessee	1,485,000	101,574	1,531,000	115,744	1,501,000	131,037	1,390,000	137,610	1,495,000	133,200
South Dakota	1,432,000	34,797	1,314,000	47,304	1,195,000	145,193	1,039,000	215,100	1,181,000	40,410
Michigan	1,345,000	30,263	1,462,000	47,369	1,392,000	61,387	1,313,000	73,260	1,313,000	47,250
Oklahoma	1,372,000	55,566	1,491,000	112,720	1,420,000	98,406	1,352,000	85,140	1,325,000	96,570
Pennsylvania	1,174,000	36,981	1,210,000	30,492	1,186,000	37,359	1,130,000	42,750	1,130,000	43,740
Florida	1,100,000	99,000	996,000	98,604	949,000	111,333	904,000	122,040	878,000	134,370
Virginia	1,023,000	34,987	1,023,000	43,273	956,000	40,009	869,000	36,000	836,000	36,090
California	994,000	31,311	947,000	34,944	877,000	37,097	797,000	37,980	822,000	36,990
South Carolina	920,000	36,432	870,000	41,265	819,000	42,383	780,000	45,630	765,000	51,660
New York	759,000	13,662	799,000	16,539	768,000	19,008	753,000	21,690	761,000	20,520
North Dakota	650,000	17,550	706,000	17,791	642,000	29,757	428,000	28,890	366,000	6,570
West Virginia	380,000	9,918	378,000	15,309	374,000	15,484	367,000	15,480	356,000	23,400
Maryland	359,000	19,063	359,000	23,909	349,000	23,871	332,000	23,310	335,000	27,190
Colorado	352,000	8,870	320,000	7,776	256,000	5,990	205,000	4,590	205,000	48,450
Oregon	315,000	5,670	370,000	8,910	360,000	7,290	300,000	5,400	2[illegible],000	7,200
Idaho	292,000	5,256	344,000	10,836	328,000	12,546	252,000	11,340	2[illegible]3,000	7,740
Washington	283,000	4,075	314,000	5,087	327,000	5,592	284,000	5,130	2[illegible]8,000	5,130
Montana	269,000	5,568	298,000	5,900	276,000	6,458	184,000	4,950	15[illegible],000	2,790
New Jersey	163,000	4,401	161,000	7,535	161,000	7,390	158,000	7,110	16[illegible],000	5,760
Vermont	113,000	2,543	113,000	2,034	108,000	2,430	106,000	2,880	107,[illegible]	1,800
Massachusetts	112,000	2,520	112,000	3,024	108,000	3,645	106,000	4,320	115,[illegible]	4,140

New Mexico	101,000	1,273	91,000	1,065	73,000	1,11[illegible]	[illegible],000	1,080	52,000	1,260
Utah	101,000	2,000	112,[illegible]00	2,923	98,000	2,690	85,000	2,430	81,000	1,800
Maine	100,000	1,800	102,[illegible]00	2,203	95,000	3,591	97,000	5,220	101,000	2,520
Arizona	80,000	2,160	40,000	720	31,000	1,040	24,000	1,170	23,[illegible]	270
Wyoming	69,000	745	70,000	630	64,000	864	51,000	900	41,[illegible]00	540
Delaware	60,000	3,240	61,000	3,569	60,000	3,37[illegible]	58,000	3,150	5[illegible],000	2,610
Connecticut	58,000	783	59,000	956	58,000	1,38[illegible]	57,000	1,800	5[illegible],000	1,620
New Hampshire	53,000	954	55,000	1,040	52,000	1,310	51,000	1,620	[illegible]2,000	1,170
Nevada	37,000	500	40,000	1,044	36,000	1,03[illegible]	33,000	1,080	3[illegible],000	630
Rhode Island	14,000	227	15,000	311	15,000	324	14,000	360	14,000	360
United States	67,453,000	2,959,322	67,766,000	4,057,884	64,618,000	5,541,971	58,933,000	6,304,320	61,178,000	6,064,470

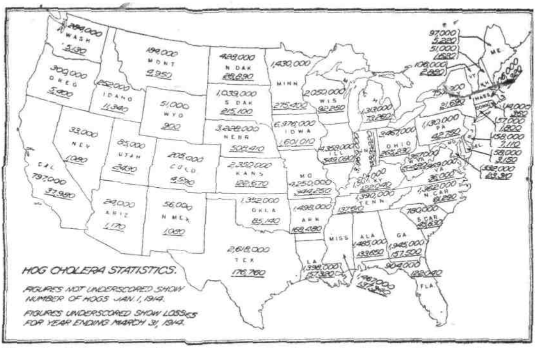

FIG. 1.—Estimated number of hogs on hand Jan. 1, 1914, and losses from hog cholera for year ending March 31, 1914.

At times the value of hogs destroyed by cholera in the Unite States has amounted to about $65,000,000 in a single year, and th average annual loss for the last 40 years probably has not been les than $30,000,000. This represents merely the direct losses; if the in direct losses could be computed these figures would be increase greatly. Figure 1 shows for each State the estimated number of hog on hand January 1, 1914, and the estimated losses from choler during the year ending March 31, 1914. Table 1 gives similar infor mation for the years 1913 to 1917, inclusive.

The losses from hog cholera in the United States during the las 24 years are shown in figure 2. It will be noted that the declin since 1914 has been quite rapid.

THE CAUSE OF HOG CHOLERA.

Hog cholera is a highly contagious disease of swine, caused by germ or microorganism which is present in the blood, urine, fece and the eye and nose secretions. It is accompanied by fever, has high death rate, and, so far as known, does not affect other animal or man.

The germ has never been cultivated artificially in laboratories, a many other infectious germs have. It can not be seen, even with the most powerful microscopes; it passes readily through the pores of the finest filters, which will hold back all visible bacteria; and it is known only by the effects which it produces. In these respects it resembles the germs that cause foot-and-mouth disease in cattle and yellow fever in man. Although insanitary surroundings and im-

proper feeding tend to lower vitality and thus perhaps render animals more susceptible to disease, such conditions can not of themselves *cause* hog cholera. It can be produced only by the specific microorganism referred to.

SYMPTOMS SHOWN BY HOGS SICK WITH CHOLERA.

The symptoms of hog cholera differ in different hogs and in different herds, depending upon the strength of the germs and the resisting power of the hogs. As a result of these variations the disease has been said to exist in two forms, acute and chronic, though the germ is the same in both. In the acute or severe type hogs sicken and die quickly, so that farmers will say that a hog which is found dead in the morning was well the night before. In the chronic or less severe type hogs may be sick for weeks or months before they succumb.

When cholera begins in a herd the hogs do not all become sick at once, but on the contrary only one or two will refuse to come up to feed with the herd. They will remain hidden in the nest (fig. 3) and when driven from the bed their backs may be arched and they may appear cold and shiver. The balance of the herd may remain

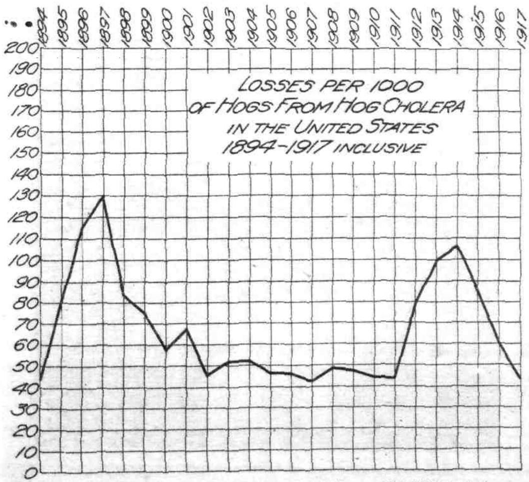

FIG. 2.—Losses from hog cholera in the United States, 1894–1917, inclusive.

apparently well for several days, when others are likely to be found affected in about the same way as those first attacked. As the disease progresses the sick hogs become gaunt or tucked up in the flank, and have a weak, staggering gait, the weakness being most marked in the hind legs.

If the lungs are affected there may be a cough, which is particularly noticeable when the hogs are disturbed. The eyes usually are inflamed and show a whitish discharge, which may cause the lids to stick together.

Constipation, which is commonly present in the early days of the disease, is generally followed by a diarrhea. As the disease reaches its height, red or purplish blotches are likely to appear upon the skin of the ears, of the belly, and of the inner surfaces of the legs.

Some of the symptoms mentioned may be present in other diseases, but the owner should remember that cholera spreads rapidly through a herd (fig. 4) and too much time should not be lost in undertaking to distinguish it from some other disease.

The temperature of the hogs is of much importance in diagnosing cholera. The normal temperature in ordinary weather when the hogs are not excited or worried will range from 101° to 104° F., but when cholera is present it is not uncommon to find a large proportion of the hogs with temperatures from 104° to 107°, and even higher.

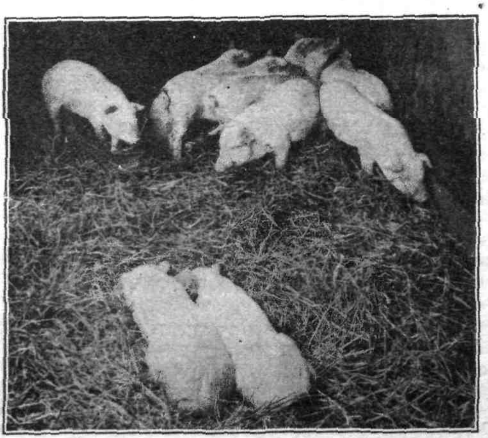

FIG. 3.—First indications of cholera; two pigs remaining in nest.

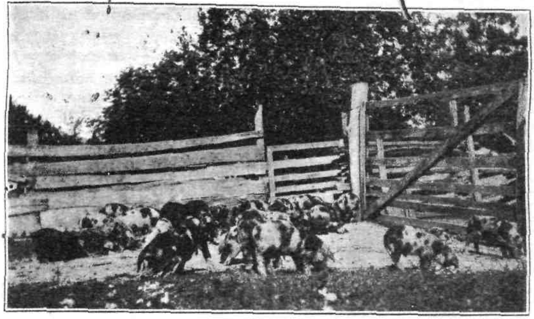

FIG. 4.—A herd affected with acute cholera in which practically every hog is sick.

APPEARANCE OF A HOG AFTER DEATH FROM CHOLERA.

Examination of carcasses of hogs that die will assist in determining whether they have died of cholera. In making an examination after death the skin should first be examined for purple blotches resembling a birth mark. Then the carcass should be placed on its back and opened in the same manner as when butchering for market, care being taken to avoid cutting the internal organs.

Lungs.—In acute cholera the surfaces of the lungs frequently show small red spots varying in size from a pinhead to a small pea. These spots can not be washed off, and when found are an important indication of cholera. It is not unusual, instead of finding the lungs soft, filled with air, and pinkish in color, as is the case in a normal condition, to find them solid and of a grayish or dark-red color, which results from a form of pneumonia. This condition, however, is not so characteristic of hog cholera as the reddish spots mentioned.

Heart.—When removed from the membranous sac surrounding it, the heart may show blotches or blood spots such as those on the lungs. These, however, are seen only in rare cases in the acute or severe form of hog cholera.

Liver.—The liver generally shows changes, but it varies in appearance even under normal conditions, and, therefore, does not show changes that can be regarded as characteristic of cholera.

Spleen or melt.—In acute cases of hog cholera the spleen or melt is invariably large, dark, and soft. In chronic cases, however, it may be smaller than normal and grayish in color.

Kidneys.—The kidneys when removed are found surrounded by a thin, fibrous tissue. This should be peeled off carefully to avoid

injury to the surface of the kidney and an examination made for dark-red spots varying in size from mere points to areas as large as the head of a pin. These spots may be few, or the surface of the kidney may be as speckled as a turkey's egg. These spots on the kidneys when well marked are regarded generally as one of the surest signs of hog cholera (fig. 5).

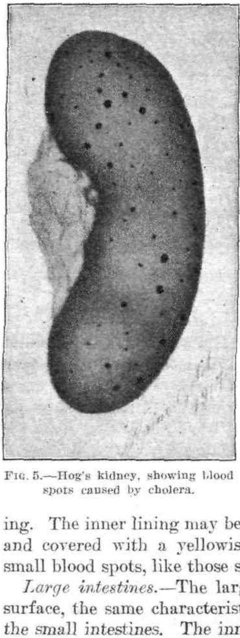

FIG. 5.—Hog's kidney, showing blood spots caused by cholera.

Bladder.—The inner surface of the bladder under normal conditions is white or a faint pinkish-white in color, but in well-marked cases of hog cholera it may show bright red specks which can not be washed off. In cases of long standing there may be ulcers.

Stomach.—In some cases of hog cholera, when the stomach is opened and washed out, red spots and ulcerations may be found on the inner lining.

Small intestines.—In some acute and virulent types of hog cholera the outer surface of the small intestines may have the appearance of being spattered with blood. The bloody spots, however, can not be removed by washing. The inner lining may be congested, inflamed, greatly thickened, and covered with a yellowish coating; or it may be dotted with small blood spots, like those seen on the outer surface.

Large intestines.—The large intestine may show, over the outer surface, the same characteristic blood spots as are seen at times on the small intestines. The inner lining in acute cases of hog cholera also may show small blood-stained areas, and in addition to this the feces found in this portion of the bowel may be covered with blood

In chronic cases, where the hog has been sick for some time, there are usually found on the inner surface of the large intestine round, hard areas called "button ulcers." These ulcers are raised above the surrounding tissue and usually are yellowish in color, while the larger ones may have a dark center. These ulcers vary in size from one-sixteenth of an inch to 1 inch in diameter, and are not found in any other disease of swine (fig. 6).

Lymphatic glands.—The changes which take place in the lymphatic glands as a result of hog cholera frequently are striking. The most important glands to be examined are found in the fat just under

the skin of the belly, in the region of the flanks. In health these glands are of a rather light-grayish color; in cases of cholera they may be enlarged and red, and in severe cases they may appear almost black. If cut through with a knife it will be found generally that the outer portion or rind of the gland is affected to the greatest extent. Other lymphatic glands which undergo similar changes are found in the fatty tissues at the angle of the lower jaw and in the thin membrane which holds the intestines together.

SUMMARY OF POST-MORTEM APPEARANCE.

To recapitulate, the important changes found in the carcass after death from hog cholera are as follows:

1. Purple blotches on the skin.
2. Blood-colored spots on the lungs, on the surface of the heart, on the kidneys, and on the outer surface and inner lining of the intestines and the stomach.
3. Reddening of the lymphatic glands.
4. Enlargement of the spleen, in acute cases.
5. Ulceration of the inner lining of the large intestine.

Any one or all of these changes may be found in a hog which has died from hog cholera. It is rare to find all in any one case. In the lingering or chronic cases of hog cholera it is usual to find the intestinal buttonlike ulcers, while the blood-colored spots described above are, as a rule, found only in the acute cases.

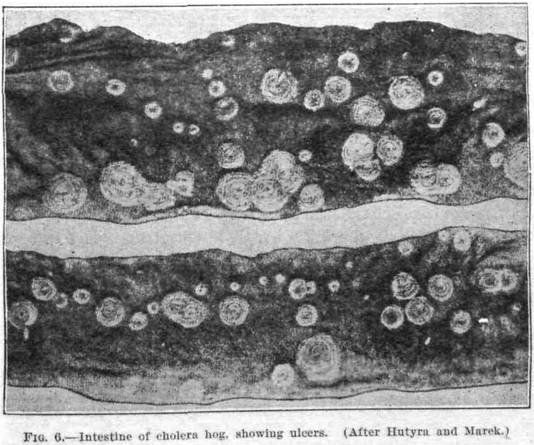

FIG. 6.—Intestine of cholera hog, showing ulcers. (After Hutyra and Marek.)

DISEASES WHICH MAY BE MISTAKEN FOR HOG CHOLERA.

A few diseases of hogs at times may be mistaken for hog cholera. These are swine plague, tuberculosis, anthrax, necrobacillosis, and lung and bowel disturbances due to worms.

Swine plague or pig pneumonia.—It is not practicable for the farmer to attempt to distinguish between hog cholera and swine plague, for they are so much alike that even skilled veterinarians may find it almost impossible to distinguish one from the other. Inasmuch as swine plague is rarely found to exist as a separate disease, and usually exists merely as a complication of hog cholera, it is best for the farmer to treat suspected swine plague just as he would a case of cholera.

Tuberculosis.—The features which distinguish hog cholera from tuberculosis are the facts that in the case of tuberculosis the onset is slow rather than sudden, as in hog cholera; and that the progress of the disease likewise is slow, it being extremely rare for hogs to die quickly from tuberculosis. It is very possible, of course, for a whole herd to show signs of tuberculosis at about the same time because of having contracted the disease from the same source and at the same time, as through feeding on tuberculous skim milk or following cattle infected with tuberculosis.

In tuberculosis the changes which may be found in the organs after death consist of whitish or grayish consolidated areas in the lungs, with sometimes a yellowish, cheeselike center. Similar areas, though not so large, may be found in the liver, and in the spleen or melt may be found nodules of varying size, some as large as an acorn. These nodules project above the surface, are light-colored, and when cut are found to consist of a tough, fibrous material which at times may have a cheesy or granular substance in the center. The appearance of the spleen is entirely different from that found in hog cholera. The kidneys do not show the small dark spots that are observed in hog cholera, and as a rule are not changed from their normal condition. Tuberculosis frequently affects the lymphatic glands, but these changes can hardly be mistaken for lesions of hog cholera, for, unlike cholera, tuberculosis causes the inner portion of the gland to break down into a yellow, cheesy mass which in the advanced stage of the disease may contain small, hard, gritty particles, resembling grains of sand.

Anthrax.—Hogs rarely are affected with anthrax, but when this disease does occur it might readily be mistaken for the acute type of hog cholera. The distinguishing features of anthrax in hogs are the marked swelling of the throat and tongue, with frequently a bloody froth in the mouth. Anthrax in hogs usually follows the disease in

other animals on the farm; cattle, sheep, and horses being more susceptible than hogs.

Necrobacillosis.—This disease may appear in various forms. One is a condition commonly called "sniffles" or "bull nose." Another and most important form is called necrotic enteritis. The latter is characterized by a severe inflammation of the intestines, and at times may be mistaken for cholera. Often there is a lack of appetite, and while diarrhea is not constant it frequently is seen in the early stage of this disease. The pigs become unthrifty, emaciated, and weak. The lesions of the disease are found most commonly in the inner lining of the large intestines, but in advanced cases the lining of the small intestines also is involved. Small, white, well-defined areas may be seen through the outer covering of the large intestines. On splitting open the intestine, the inner lining is found thickened, with white, dead patches ready to slough off, but they are not raised above the surface and do not form the buttonlike ulcers as in chronic cholera. These patches consist of a rather soft cheesy substance. In advanced cases the whole inner lining of the intestine can be scraped away with the thumb nail. Under these conditions the animal rapidly wastes away and dies from lack of nutrition. The absence of red spots on the belly, the lack of fever, the slow development of the disease in the herd, and the fact that it is confined principally to pigs and shoats, all serve to distinguish this disease from cholera.

Worms.—Growing pigs often suffer from attacks of worms, both in the lungs and in the intestines, but old hogs rarely show the effect of such infestation. The most important symptom produced by worms is general unthriftiness.

The worms that infest the lungs are very small, one-half to 1 inch in length, and they bring about an inflammation of the air passages which causes frequent coughing. They can be recognized by a careful examination of the frothy discharge from the mouth of sick pigs or of the lungs after death. In this disease there is an entire absence of symptoms of acute illness, such as usually accompanies an attack of hog cholera.

Worms infesting the intestines vary in size, some attaining a length of 10 inches. These parasites impair the general health of the pigs and by causing irritation of the alimentary tract may cause diarrhea. While several pigs and shoats in a herd may become affected with worms and act in somewhat the same way as those attacked by hog cholera, the facts that there is no fever and that the ailment does not affect grown hogs make this trouble easily distinguishable from hog cholera.

MODES OF INFECTION WITH HOG CHOLERA.

Hog cholera does not occur in a herd except through the introduction of the specific germ of that disease. So far as known, the germs of hog cholera develop and propagate only in the bodies of hogs. There is no more certain way of introducing hog cholera than by placing in the herd a hog already infected with the disease. The sick hog, then, must be regarded as the most dangerous agent in the spread of cholera. Hogs affected with cholera discharge the germs of the disease from their bodies in the urine, the feces, and the secretions of the nose and eyes. Therefore the manure, bedding, litter of all sorts, and the dirt itself in pens where sick hogs are kept contain the germs of the disease. These germs may enter the hog's system by means of food or drink and probably also through wounds or abrasion of the skin.

The extensive shipment of hogs to market by rail has resulted in the germs of cholera being deposited in public stockyards, in unloading chutes and pens, and in the railroad cars used for hauling hogs. Consequently if healthy hogs are shipped in ordinary stock cars, or if they are unloaded in public stockyards or through public chutes they are likely to become infected with cholera. Similarly, it is believed that any agency which will serve to carry litter, manure, or material of any sort from public stockyards or cars to farms may result in an outbreak of cholera on the farm. Such infected material may adhere to the feet of horses or other stock, to wagon wheels, or to the shoes of men who have entered these public places.

What is true of public stockyards and stock cars is true to an even greater extent of farms where cholera exists, and it may be expected that the disease will be carried from an infected farm to healthy herds if care is not taken to prevent the carrying of the germs on the feet of men or animals, on wagon wheels, or perhaps even by dogs roaming from one farm to another. Streams passing through infected farms may wash the germs down to other farms perhaps miles away. If the carcasses of dead animals have not been disposed of promptly, dogs may carry portions to neighboring farms. It is generally believed that buzzards and crows may carry the germs of cholera to clean farms. At certain seasons it is common for farmers to exchange labor and farm implements when thrashing, shelling corn, filling silos, and delivering grain or stock to market. Unless proper precautions are taken it can be seen that these practices may serve to disseminate cholera. It has been said that cholera has been traced in some instances to the visits of stock buyers and vendors of stock remedies who go from farm to farm and from hog lot to hog lot. If hogs on a clean farm are not kept in lots properly fenced they may range to contaminated streams or to adjoining

herds and thus contract and spread cholera. It is undoubtedly true that infection in many cases results from the purchase of new stock, and at times from the borrowing and lending of stock for breeding purposes. There is a record of six different farms having become infected from the purchase of stock from one public sale where sick hogs were kept hidden from view. A number of outbreaks have been caused by the failure to take proper precautions in the case of stallions and other breeding animals which were kept on infected premises from which infection was carried through the community from farm to farm.

Farms on which hog cholera has occurred may remain infected for a considerable time, and a second outbreak may occur as a result of this infection.

KEEPING CHOLERA OFF THE FARM BY SANITATION.

From what has been said it will be seen that hog cholera may be spread in many ways, and that most, if not all, of the sources of danger may be excluded by the use of proper care and foresight on the part of the farmer.

With the object of assisting the farmer to protect himself the following suggestions are offered: Hog houses, lots, and pastures should be located away from streams and public highways, and the houses and lots should be arranged so that they may be cleaned and disinfected readily. They should be exposed as far as possible to sunlight, which is the cheapest and one of the best disinfectants. Hog lots should not be used for yarding wagons and farm implements and should not be entered with team and wagon, particularly when loading stock for shipment to market and when returning from stockyards and public highways. No one should be allowed to enter hog lots unless there is assurance that he does not carry infection. Farmers and their help should disinfect[1] their shoes before entering hog lots after returning from public yards, sales, and neighboring farms.

Wallow holes and cesspoles should be drained, filled in, or fenced off.

Runs underneath buildings should be cleaned and disinfected and then boarded up. Straw stacks that have been frequented by sick hogs should be burned or removed to the field and plowed under. In fact, it is a dangerous practice to leave remnants of stacks from year to year, and new tenants should beware of this source of danger.

Hogs that do not recover fully from cholera should be destroyed, as they remain constantly dangerous.

[1] Compound cresol solution (U. S. P.), or a suitable substitute therefor, may be a very satisfactory disinfectant for use against hog cholera. The substitute for compound solution of cresol (see B. A. I. Order 245, p. 5) is called "saponified cresol solution." Both products contain 50 per cent of cresol. They are used in 3 per cent solution. This solution is made by adding 4 fluid ounces of the concentrated disinfectant to 1 gallon of soft water.

All animals that die on the farm, as well as the entrails removed from animals at butchering time, should be properly disposed of by burning to ashes, or by burying with quicklime away from streams and low places. Unless disposed of in this way they will serve to attract buzzards, crows, and dogs that may bring or carry away the germs of hog cholera.

Newly purchased stock, stock borrowed or loaned for breeding purposes, and stock exhibited at public fairs should be placed in isolated pens and kept there for at least 15 days before being turned in with the herd. During this quarantine care should be used to prevent carrying infection from these to other pens by those who feed or care for stock.

Hogs should not be allowed to follow newly purchased stock unless such stock has been dipped or driven through a suitable disinfectant.

If hog cholera appears on the farm a notice should be posted at the entrance to the premises reading "HOG CHOLERA—KEEP OUT," and all neighbors should be warned so that they may protect their herds. The infected herd should be confined to limited quarters that can be cleaned daily during the presence of the disease and *sprayed occasionally with a disinfectant consisting of 1 part of* compound cresol solution to 30 parts of water, or with a recognized substitute therefor.

PREVENTION BY INOCULATION.

Up to the present time no drug or combination of drugs is known which can be regarded as a preventive or cure for hog cholera in a true sense of the word. It is true that a number of preparations on the market composed of drugs and chemicals are advertised to protect hogs against cholera or to cure hogs affected with cholera. Many of these so-called cures have been tested by Federal or State institutions, and one and all have been found to be worthless. Farmers therefore are warned against investing their money and *placing their faith in hog-cholera medicines. Only one agent known* can be regarded as a reliable preventive. That agent is "anti-hog-cholera serum," prepared according to the methods originally worked out by the Bureau of Animal Industry. This serum is prepared as follows:

Hogs that are immune against cholera, either naturally, as a result of exposure to disease, or as a result of inoculation, are injected with large quantities of blood from hogs sick of cholera. The blood, which contains the virus from the sick hogs, even in minute quantities, would kill susceptible pigs but does not injure immunes; on the contrary, it causes immunes to become more highly immune. After the immunes are injected with virus as stated, they are called "hyperimmunes." About 10 days or 2 weeks after an immune has been

hyperimmunized its blood contains a large amount of protective substances or antibodies, and it is from such blood that anti-hog-cholera serum is prepared.

The fact that a serum made in this way will protect hogs from contracting cholera was first brought to the attention of the authorities in the various States by the Bureau of Animal Industry in 1908-9. Following this several State institutions began the preparation and distribution of the serum, and subsequently its manufacture was taken up by private concerns all over the United States. The efficacy of the serum is now recognized generally both in the United States and in foreign countries.

While the serum is regarded as most efficacious when administered as a preventive, it undoubtedly has considerable curative value provided it is administered when hogs are in the very early stages of the disease.

Beginning in 1913, the Bureau of Animal Industry conducted experiments in 17 counties in 15 different States to determine the possibility of reducing losses from hog cholera by a systematic campaign embracing limited quarantine and sanitary measures and the use of the preventive-serum treatment. In the course of these experiments 234,136 hogs were treated in infected herds, with a loss of 13.1 per cent, notwithstanding the fact that 85,547, or 36.5 per cent, of the number were sick, showing high temperatures or other evidences of disease at the time of treatment.

During the same period 19,208 hogs were treated in uninfected herds for protection, with a total loss of only 49 hogs, or one-fifth of 1 per cent. The few deaths recorded probably were due to causes other than cholera, and the losses from that source may be regarded as nil.

The results of these experiments are shown in the following tables:

TABLE 2.—*Results of serum treatment in infected herds, 1913, 1914, and 1915.*

Condition of hogs and method of treatment.	Hogs treated.	Hogs died.	
	Number.	*Number.*	*Per cent.*
Hogs sick when treated:			
Simultaneous [1]	2,448	713	29.1
Serum alone [1]	83,099	23,990	28.8
	85,547	24,703	28.8
Hogs apparently well when treated:			
Simultaneous	81,289	3,070	3.7
Serum alone	67,300	3,063	4.5
	148,589	6,133	4.1
Total	234,136	30,836	13.1

[1] The two systems of inoculation used in protecting hogs from cholera are explained under later headings.

TABLE 3.—*Results of serum treatment in exposed herds (apparently well when treated), 1913, 1914, and 1915.*

Mode of treatment.	Hogs treated.	Hogs died.	
	Number.	*Number.*	*Per cent.*
Serum alone	10,679	34	0.3
Simultaneous	8,529	15	0.1
Total	19,208	49	0.2

METHOD OF ADMINISTERING SERUM.

Two systems are used in protecting hogs from cholera by inoculation—the "serum-alone inoculation" and the "simultaneous inoculation." These two systems will be discussed later. At this point it is proposed merely to describe the mode of handling the herd and the manner of making the injection.

Before beginning the treatment of an infected herd, the sick and the apparently well hogs should be separated and each lot confined in a pen or inclosure that may be cleaned and disinfected. A section of the inclosure should be arranged for holding a small number of animals, where they may be caught readily for inoculation without worrying them or exciting the herd. Otherwise they may crowd together and thus cause, particularly in warm weather, an elevation of temperature that may be misleading. It is advisable to withhold feed from all hogs in the herd for at least 12 hours before treatment.

An ample supply of hot water and clean pails should be on hand for preparing disinfectants and for use in keeping the instruments and the operator's hands clean.

The syringes and needles should be not only absolutely clean, but sterilized by boiling in water for 5 or 10 minutes. A table or bench, covered by clean towels, should be provided for the syringes and other instruments, and there should be a bucket containing a disinfectant[1] for rinsing the instruments and the hands of the operator when they become soiled. (Fig. 7.)

The serum may be poured into a small glass bowl or jelly jar previously cleaned and sterilized by boiling. This should be kept covered with a clean metal or glass lid when not in use. A large tube passed through the cork and reaching to the bottom of the serum bottle, one end being made to fit the syringe the same as the needle, does away with the need for a bowl and provides a more sanitary method of filling the syringe.

The needle should be removed from the syringe after each injection and placed in a small, shallow receptacle containing a disin-

[1] See footnote on p. 15.

fectant, the syringe being filled with serum before the needle is replaced. If the nozzle of the syringe becomes soiled, it should be washed thoroughly before further use. Cleanliness will reduce the possibility of abscesses and blood poisoning.

Sufficient help should be provided to hold the hogs in proper position for treatment. Large hogs that are too heavy to handle in any other way may be snared by the upper jaw and snubbed to a post. In such cases the injection is made beneath the skin back of the ear (fig. 8). Hogs of ordinary size may be handled conveniently in a V-shaped trough (fig. 9) or on a small platform slightly elevated from the floor. This places the hog in a position for making the injection between the foreleg and the body, which is regarded by many as the

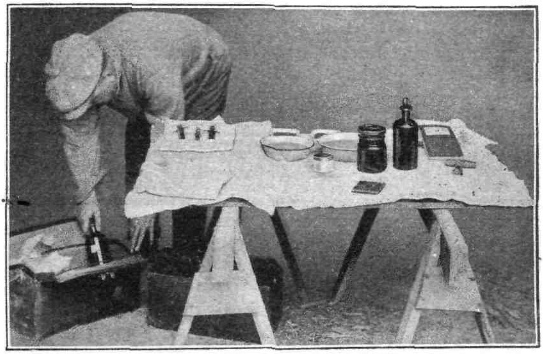

FIG. 7.—Inspector getting equipment ready for treating herd.

most desirable location. Small pigs and shoats up to 75 or 80 pounds usually are held up by the hind legs and the injection is made beneath the skin into the loose tissues of the flank (fig. 10). This is the most convenient and rapid way of handling small pigs, as they may be held by one man and are in a suitable position for taking the temperatures. Injection into the ham should be avoided, particularly in grown hogs that are to be placed on the market before they have time to recover fully from the injection, as abscesses may develop and remain undiscovered until the ham is cured and placed on the market.

The temperatures of all hogs should be taken and recorded before they are treated, and those showing high temperatures—that is, above 104° F.—should be marked so that they may be identified after

FIG. 8.—Injection back of ear.

the treatment has been completed. This marking is done usually by placing a hog ring in the upper border of one ear. Hogs that are in an advanced stage of the disease should, as already stated, be destroyed; if for any reason this is not done, they may be marked by placing two rings in one ear or one in each ear.

It is an injustice to the operator, to the owner of the herd, and to the serum producer to administer serum to hogs without at the same time taking and recording the temperatures. It is not uncommon to find a herd which appears to be perfectly healthy, although a large percentage of the hogs may have high temperatures. If such herds are treated without knowledge of this condition, the owner may be led unjustly to condemn the serum or the man who applied it, for some losses are likely to occur, particularly if the operator is not warned beforehand by the temperatures of the need for large doses of serum. On the other hand, if the temperatures are taken the operator knows whether to give an ordinary dose of serum for a

healthy hog or the larger dose which is essential for those showing evidences of cholera, and he also knows whether it is wise to give the simultaneous inoculation.

Before making an injection, either of serum or of virus, the skin covering the point selected should be cleaned thoroughly and washed with a disinfectant. The needle is then inserted through the skin for a distance of about 1 inch so that the point rests in the loose tissues immediately beneath. As the injection is made slowly, the needle may be withdrawn very gradually. Not more than 10 cubic centimeters of serum in the case of small pigs, nor more than 30 cubic centimeters in the case of larger animals, should be injected in one place, and when virus also is used it should be injected on the opposite side of the body or at least some distance from the serum.

CARE OF HOGS AFTER TREATMENT.

Success in the treatment of infected herds will depend greatly upon the care given the hogs after treatment. They should be retained in small inclosures, which should be cleaned daily and sprayed with a disinfectant until the disease has abated in the herd. All dead hogs should be properly disposed of at once. Under no circumstances should sick hogs be allowed to roam over areas which it would be difficult to disinfect, nor should they be allowed to come in contact with healthy hogs. During the first week or 10 days after treatment

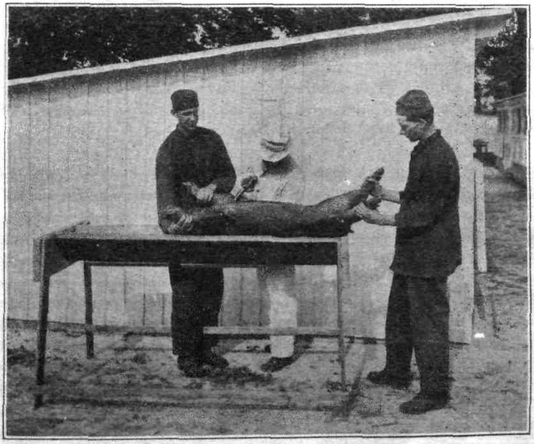

FIG. 9.—Injection between foreleg and body (axillary space).

FIG. 10.—Flank injection.

only a moderate quantity of light feed should be given to the hogs, and thereafter they should be returned to full feed and whole grain very gradually.

SERUM-ALONE INOCULATION.

The serum-alone inoculation consists merely in injecting, in the manner just described, the serum which is obtained from hyper-immunized hogs. The serum may be used either to immunize healthy hogs or to treat those that are sick of cholera. Good serum, properly administered, is incapable of causing any harm to the treated animals. It does not contain the germs of hog cholera and therefore can not start an outbreak of cholera, even when the methods of application are faulty or the serum is of low potency. It is in the safety of this method of treatment that its chief advantage lies.

This method is always to be recommended in preference to any other for treating sick hogs. Unfortunately, in healthy hogs not infected with cholera it does not produce a permanent protection. If it did it would certainly be the only method to be recommended. The length of protection which follows the injection of serum alone seems to depend to a certain extent upon the peculiarities of individual hogs, which can not be determined beforehand, and also to some extent upon the dose of serum. Certain experiments have indicated that the immunity lasts somewhat longer in hogs which receive exceptionally large doses. Ordinarily a farmer may count upon the immunity lasting at least 3 or 4 weeks following the treatment of healthy hogs with serum alone. This immunity seems to last longer in old hogs than in young pigs. In some cases it apparently produces immunity which lasts for 2 or 3 months. At times, when healthy hogs are treated with serum alone and shortly there-

after exposed to cholera, they seem to acquire a permanent immunity, but this is not always the case, and therefore serum alone can not be depended upon to produce a lasting immunity even though the treated pigs be promptly exposed to cholera.

It has been stated that serum alone can be used to treat sick hogs. This is true within certain limitations. Ordinarily it is efficacious in the very early stage of the disease, but apparently has only slight effect when the disease has advanced so that a hog shows visible signs of sickness, such as weakness, lack of appetite, sluggishness, etc.

DOSAGE OF SERUM ALONE.

The quantity of serum required for producing immunity or for curing infected animals is influenced by a number of conditions, chief among these being the condition and susceptibility of the pigs and the strength or potency of the serum which is used. No hard and fast rule can be laid down, but as a sort of general guide the doses in the following table are suggested:

TABLE 4.—*Doses for serum-alone inoculation.*

Weight of hog.	Dose of serum.
Below 10 pounds	10 cubic centimeters.
10 to 15 pounds	15 cubic centimeters.
20 to 30 pounds	*20 to 25 cubic centimeters.*
40 to 75 pounds	30 cubic centimeters.
100 to 150 pounds	40 to 60 cubic centimeters.
175 pounds and over	80 cubic centimeters.

If the herd is infected the dose of serum should be increased slightly for all apparently well hogs, and all hogs showing high temperatures or other evidence of disease should receive at least a dose and a half of serum.

From what has been said, it will be seen that serum alone is to be recommended particularly under the following conditions:

1. For the treatment of hogs in the very early stages of the disease, as shown by the presence of fever rather than by visible symptoms.

2. For the treatment of hogs which need to be protected for only a short time, as, for example, a herd which is to be sent to market within 3 or 4 weeks. Or in the case of hogs which are to be shipped by rail and thus perhaps exposed to infection for only a short time while in transit.

3. In the case of very young pigs, when the administration of the simultaneous inoculation is objected to by the owner. In such a case, however, the pigs should be removed immediately and kept from exposure to infection, such as infected lots, or else within 3 or 4 weeks they should receive the simultaneous inoculation or a second injection of serum alone.

SIMULTANEOUS INOCULATION.

In the simultaneous method of inoculation hog-cholera virus is used in addition to the serum. It has been stated above that the serum alone produces an immunity which lasts for only a very short time. The theory of the simultaneous inoculation is to administer the germs of hog cholera in the virus and at the same time to give a dose of serum which will protect the hogs from cholera. The virus enters the system of the hog and causes a reaction which results in immunity like that which is found in hogs that recover from a natural attack of the disease. The serum being given at the same time prevents death or serious sickness which would otherwise be caused by the virus, and through the combined action of these two agents the hogs are rendered immune against cholera for life.

In administering the simultaneous inoculation the serum is injected in the manner already explained, and the virus is injected in the same manner but on the opposite side of the body. The virus, of course, is given in a very small dose as compared with the serum. The doses for simultaneous inoculation are indicated in Table 5.

TABLE 5.—*Doses of serum and virus in simultaneous inoculation of healthy hogs.*

Weight of hogs.	Dose of serum.	Dose of virus.
Below 10 pounds	10 cubic centimeters	
10 to 15 pounds	15 cubic centimeters	$\frac{1}{4}$ cubic centimeter.
20 to 30 pounds	20 to 25 cubic centimeters	$\frac{1}{2}$ cubic centimeter.
40 to 75 pounds	30 cubic centimeters	1 cubic centimeter.
100 to 150 pounds	40 to 60 cubic centimeters	2 cubic centimeters.
175 pounds and over	80 cubic centimeters	2 cubic centimeters.

If the herd is infected, the dose of serum should be slightly increased for all apparently healthy hogs, and all those showing high temperatures or other evidence of disease should receive at least a dose and a half of serum and no virus.

While the serum alone has the advantage of being harmless, it should be remembered that it has the disadvantage of producing only a transitory immunity. The conditions are precisely reversed in the case of the simultaneous inoculation. In this case the immunity is prolonged, and it is rare to find a hog which has been immunized properly by the simultaneous method which again becomes susceptible to cholera. The principal objection to the simultaneous inoculation is the element of danger caused by the injection of the virus of cholera. If the serum should not be of proper strength, or if a sufficient dose of serum should not be administered, or if the work is not done properly, a case of hog cholera may be produced. Sufficient work, however, has been done to show that the simultaneous inoculation can be administered with safety. Certain important things are to be remembered in this connection. Use

good serum, and give plenty of it. Enough serum should be given to prevent any signs of illness in the treated hogs. To get a lasting *immunity it is not necessary* to render the hogs visibly sick from the injection. Apparently just as firm immunity is secured when hogs show no symptoms of illness as when they are made sick by the injection. This treatment should be handled carefully, and those who have studied this question agree that the simultaneous inoculation should be administered only by competent veterinarians or by skilled laymen who have had adequate training in its use.

The prolonged immunity caused by the simultaneous inoculation is much to be desired for several reasons. It prevents the recurrence of cholera in the treated hogs; it eliminates the additional expense of re-treatment; and, in the case of infected premises, it affords a better opportunity to eliminate the germs of the disease, thus removing a source of danger from the neighborhood.

It is of the greatest importance, when applying the simultaneous inoculation, to give an ample dose of serum. Many of the commercial serums bear labels which show the smallest dose that is recommended for use. In no case will harm be done by increasing this dose. It is much better to give a little more serum and save the treated pig at an added cost of a few cents than to lose it through failure to give enough serum. In general the dose of serum required in the simultaneous inoculation may be said to depend upon the age, weight, and condition of the animal, but the amount of serum required is not in direct proportion to the weight, for small pigs and shoats require a larger dose in proportion to their weight than older animals, and in all classes of hogs which show high temperatures but no other evidence of disease, a larger dose of serum should be given than when healthy hogs are being treated. *No pig should receive less than 10 cubic centimeters of the ordinary* commercial serum, and 80 cubic centimeters may be regarded as a sufficient dose for a healthy hog weighing 200 pounds or over.

The syringe used for injecting the virus should be in perfect order and care should be taken to see that the amount of virus prescribed in the dose table is actually injected into and retained by each animal.

TREATMENT OF HERDS.

Healthy herds.—No definite rule can be laid down as to the necessity for treating healthy herds or as to the method to be used in treating them. In general it can be said that the necessity for the treatment of healthy herds depends upon surrounding conditions, that is, the proximity of cholera and the ability of the farmer to protect his herd from the infection. It has been demonstrated

that susceptible hogs may be kept within a few feet of cholera hogs without becoming infected if care is taken to prevent the infection being carried from the sick to the healthy animals. On the other hand it has been noticed in practice that at times herds on farms immediately adjoining outbreaks of cholera may escape the disease, while farms several miles away become infected. It is probable that the ways in which cholera spreads are not yet fully understood, but it is known that there are certain channels through which it frequently is carried from farm to farm. These have been discussed in the section headed "Modes of Infection."

Notwithstanding the fact that at times herds on farms adjoining an outbreak of cholera may escape the disease, it seems to be good practice for farmers to protect their herds by inoculation when cholera exists in the immediate neighborhood. This is particularly true where the infected herd is not kept under strict quarantine and where the quarters of the sick pigs are not continually cleaned and disinfected. The serum-alone treatment may prove sufficient for protecting healthy herds under such circumstances, particularly if the disease on the neighboring infected farm is stamped out in a short time and the premises are cleaned and disinfected properly. As a general proposition, however, it would appear to be better to use the simultaneous inoculation for protecting healthy herds, provided this treatment can be given by a competent veterinarian or by a layman who is well trained and thoroughly familiar with the work. After immunizing healthy herds in this way they should be handled in very much the same way as an infected herd after treatment; that is, the feed should be light, not much grain should be fed, and the hogs should be kept in a clean, disinfected yard where they can be watched carefully from day to day. In case the disease appears in a herd after treatment, it should be re-treated promptly with serum alone.

Diseased herds.—In the field experiments conducted by the Bureau of Animal Industry in 17 different counties during 1913, 1914, and 1915, it was the practice in some of the counties to use the serum-alone treatment exclusively. In the remainder of the counties all of the apparently healthy hogs in diseased herds received the simultaneous inoculation, while the sick hogs, including all those showing temperatures above 104° F., received the serum alone. So far as the results of treatment are concerned, the losses from cholera were practically the same in the two sets of counties. However, in those counties where serum alone was used on all hogs, whether sick or not, in diseased herds, there was more or less recurrence of disease among the treated hogs. In other words, the healthy hogs in the diseased herds were protected for some weeks but later lost this immunity, and the infection being still on the farm they then contracted cholera.

In the counties where the simultaneous inoculation was used on all apparently healthy hogs in infected herds there were comparatively few cases of recurrence of disease, and when this was found it took place among hogs which received the serum alone. In other words, some hogs supposed to be infected when treated and which therefore received the serum alone, were probably not actually sick of cholera. They were protected for the time being, but later lost the immunity and contracted cholera from the infection which remained on the premises. In those herds where the sick hogs received serum alone and the apparently healthy hogs received the simultaneous inoculation, perhaps the results would have been still better, so far as recurrence of disease is concerned, if hogs showing temperatures above 104° F. had also been given the simultaneous inoculation. Table 2 indicates this possibility.

When it is considered that the hog lots and buildings on a farm where cholera exists are already infected with the germs of the disease and that they may remain so for a long time after treatment, it seems that there is much to be said in favor of giving the simultaneous inoculation to all apparently healthy hogs (temperature 104° F. or less) and the serum alone to the remainder, remembering, of course, that the destruction of severely sick hogs is sometimes advisable because the serum treatment can not be expected to cure very many such cases.

EFFECT OF TREATMENT ON PREGNANT SOWS.

The question frequently is raised as to the advisability of administering serum and virus, or even serum alone, to pregnant sows. Decision in this respect probably should be governed somewhat by the condition of the herd. If infection has already appeared it is generally conceded that without treatment the loss will be from 80 to 85 per cent of the entire herd and that pregnant sows will likely abort, while sows that live through the disease will not breed until they have recovered fully. Therefore, there can be no question as to the advisability of treating sows in infected herds, regardless of the stage of pregnancy. Even though there be no hope of saving the litter there is a possibility of saving the sows and of enabling them to recover more rapidly and in better condition than if they were not treated.

The method of treatment may be a matter of choice, as the results are practically the same. Statistics on the subject are compiled in the following tables, Table 6 showing the results of treatment of pregnant sows in infected herds and Table 7 the same in healthy herds:

TABLE 6.—*Observations following treatment of pregnant sows in infected herds.*

Method of treatment.	Sows treated.	Sows aborted.	
	Number.	*Number.*	*Per cent.*
Serum alone	3,235	261	8.0
Simultaneous	1,357	98	7.2

TABLE 7.—*Observations following treatment of pregnant sows in exposed herds.*

Method of treatment.	Sows treated.	Sows aborted.	
	Number.	*Number.*	*Per cent.*
Serum alone	126	2	1.5
Simultaneous	38	0	0.0

EFFECT OF SIMULTANEOUS INOCULATION ON FERTILITY.

In connection with the field experiments previously referred to, 2,362 healthy brood sows in 181 herds received the simultaneous inoculation, and 95 per cent of them produced pigs the following year. During the same time observations were made of 1,840 healthy sows on 148 farms that were not treated, and it was found that 94 per cent of these produced pigs the following year. (See Table 8.) From these observations it is fair to conclude that the simultaneous method,

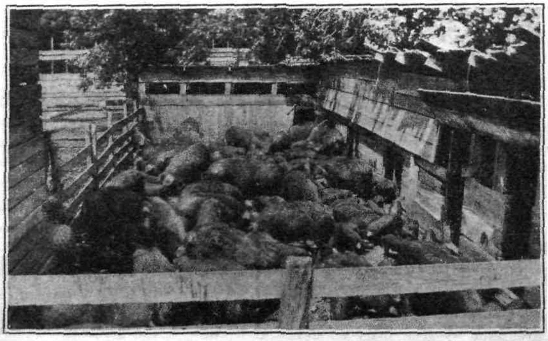

FIG. 11.—Fertility of sows following treatment. This picture shows a portion of a herd of 40 brood sows immunized by simultaneous inoculation in the fall of 1913. Fig. 12 shows their litters the following spring.

FIG. 12.—A portion of 312 pigs, at the age of 40 to 60 days, produced by 40 immunized sows (see fig. 11).

when properly applied to healthy brood sows, does not produce sterility. The very fact that hyperimmune sows—that is, sows that are used for serum production and have received enormous doses of hog-cholera virus, generally farrow normal litters, confirms these observations. (See figs. 11 and 12.)

TABLE 8.—*Summary of investigations as to effects of simultaneous inoculation on fertility of brood sows.*

Healthy brood sows.	Herds.	Sows.	Produced pigs following year.
	Number.	*Number.*	*Per cent.*
Treated with serum and virus	181	2,362	95.0
Not treated	148	1,840	94.4

TREATMENT OF YOUNG PIGS.

Pigs may be treated either with serum alone or with the simultaneous inoculation, regardless of age. If young pigs receive both serum and virus the immunity, as a rule, is lasting, and only an exceptional herd or individual will then contract cholera. Pigs from sows which are actively immune when bred rarely contract the disease during the sucking period; after that time they are likely to become susceptible. Pigs from immune sows apparently do not always become permanently immune from simultaneous inoculation. There-

fore, if cholera should appear on the premises such pigs should be treated in the same way as the remainder of the herd.

The opinion that pigs weighing less than 60 to 75 pounds can not be immunized successfully by the simultaneous method has become more or less current in some sections of the country. The best available information indicates that this is not true. If ample serum is administered with the virus these small shoats can be treated by the simultaneous inoculation with safety, and certainly the great majority of them will derive a lasting immunity from the treatment.

In testing hog-cholera serum to determine its potency it is common to use pigs of this weight, and the test is made by giving them a simultaneous inoculation of serum and virus. If the serum is good these pigs remain in good health, and they are commonly given, when they have attained a weight of 150 pounds or more, large doses of virus to render them hyperimmune, for the production of serum. At this time, as a rule, they are found to be firmly immune as a result of the original simultaneous inoculation.

RESTOCKING AFTER AN OUTBREAK OF HOG CHOLERA.

In some instances the infection of hog cholera disappears within a few weeks, while in other cases it remains for months. The infection is more likely to be eliminated quickly in summer than in winter. This is probably due to putrefaction and fermentation of infected material, as experiments have shown that the virus of hog cholera is usually destroyed by those processes. In the cold months of winter, putrefaction and fermentation do not take place, and infection persists for a longer time. No statement can yet be made of the exact time required for the elimination of infection on farms.

Sick hogs are a constant menace to nonimmune hogs, therefore susceptible hogs should not be placed on a farm so long as any sick hogs remain on the premises. Nonimmune hogs should not be brought on the farm where infection has existed until the premises have been cleaned up by destroying old troughs, rubbish, litter, and other material which may be contaminated. As a general rule the introduction of susceptible hogs on previously infected farms can not be regarded as safe at any season within less than 3 months after the last sick hogs have been removed. Therefore it seems advisable to immunize all new stock, including new litters, introduced on the farm within 90 days after all hogs have recovered.

TONIC COMPOUND.

There are many so-called "tonics" advertised to do wonders for hogs, and some of them may have merits as condition powders. None, however, is of any value as a cure or preventive for hog

cholera. The following formula has been used by farmers for a number of years and is probably as good as any other for a condition powder, but it will not serve to cure or prevent cholera:

Wood charcoal	1 pound
Sulphur	1 pound
Sodium chlorid	2 pounds
Sodium bicarbonate	2 pounds
Sodium hyposulphite	2 pounds
Sodium sulphate	1 pound
Antimony sulphid (black)	1 pound

These ingredients should be mixed thoroughly and given with the feed in the proportion of a large tablespoonful to each 200 pounds weight of hogs not oftener than once a day.

CONCLUSION.

The end in view in combating hog cholera is the ultimate elimination of the disease, though at present it seems wiser to consider control rather than eradication.

Experiments of the Bureau of Animal Industry have demonstrated the possibility of greatly reducing the losses from hog cholera wherever the farmers are willing to cooperate and take steps to prevent the spread of infection and secure the proper treatment of their herds.

Permanent reduction in losses from cholera can be expected only when farmers organize in a determined effort consisting principally of self-imposed quarantine, the continuous employment of sanitary measures, and the early use of the serum treatment should the herd become infected or dangerously exposed.

It is important that competent veterinarians or trained laymen be employed and that cooperation and support be given to any movement by State and Federal authorities for the eradication of hog cholera. If, however, farmers will not unite in this way, the complete extirpation of the disease can not be expected.

The United States Department of Agriculture does not prepare anti-hog-cholera serum for sale or distribution. For information as to where serum may be obtained and the help that may be had in combating hog cholera, write the Bureau of Animal Industry, United States Department of Agriculture, Washington, D. C., or the State Veterinarian, Live Stock Sanitary Board, or State Agricultural College.

TO KEEP HOG CHOLERA FROM REACHING YOUR HERD.

LOCATE your hog lots and pastures away from streams and public highways, and do not allow your hogs to run on free range or highways nor to have access to canals or irrigation ditches.

Do not visit your neighbor's farm nor allow him to visit yours if there is hog cholera on his premises.

Do not drive into hog lots after driving on public highways.

Do not use hog lots for yarding wagons and farm implements.

Do not place newly purchased stock, stock procured or borrowed for breeding purposes, or stock exhibited at county fairs immediately with your herd. Keep such stock quarantined in separate pens for at least two weeks, and use care in feeding and attending stock to prevent carrying infection from these to other pens.

Burn to ashes or cover with quicklime and bury under 4 feet of earth all dead animals and the viscera removed from animals at butchering time, because they attract buzzards, dogs, etc., which are likely to carry hog-cholera infection.

If hog cholera appears in the neighborhood, confine your dog and encourage your neighbor to do the same.

IF HOG CHOLERA APPEARS IN YOUR HERD.

Have all hogs treated immediately with anti-hog-cholera serum, after which they should be kept on a light diet, for a few days, with pure drinking water, and confined to limited quarters that should be cleaned and sprayed occasionally with 1 part of compound cresol solution to 30 parts of water, until the disease has abated in the herd.

To obtain the best results the serum must be administered as soon as the disease can be detected in the herd. Be sure that the temperature of all hogs is taken. A temperature above 104° F. in ordinary weather and when the animal is not excited indicates the necessity for an increased dose of serum.

TO RID PREMISES OF INFECTION.

Collect all manure in piles away from hogs and allow to rot.

Burn all litter, rubbish, and old hog troughs.

After the premises are thoroughly cleaned, spray walls, floors, and other surfaces, including remaining hog troughs, etc., with a disinfectant (1 part compound cresol solution to 30 parts water). Where hog houses are small, turn them over, exposing interior to sunlight.

Cleanliness and sunlight help to destroy infection.

Wallow holes and cesspools should be filled in, drained, or fenced off.

All runs underneath buildings should be cleaned and disinfected and then boarded up to keep hogs out.

Destroy hogs that do not fully recover, as they may be carriers of cholera infection.